field noise measurements. Field measurements of 15 minutes in duration were conducted at the selected monitoring sites using a Quest Technologies 2900 Integrating/Logging Sound Level Meter. The ambient noise level monitoring sites were chosen to be representative of the noise sensitive land uses adjacent to the proposed project and characteristic of the existing background noise levels in the vicinity. Simultaneous traffic counts were recorded for nearby roadways as applicable.

3.8 WATER RESOURCES

3.8.1 Surface Water Resources

The proposed project is located in the center of Texas' Coastal Bend region of connected river deltas, estuaries, bays, and marine open water environments. Coastal Bend estuarine habitats are especially critical for their substantial biological productivity as well as their sensitivity to small changes in salinity, nutrients, anthropogenic pollutants, and other water quality factors. The following sections provide a regional overview of water resources issues, with a focus on the sub-regions most likely to be potentially affected by the proposed project alternatives: the Nueces River and Delta, Nueces Bay, Corpus Christi Bay, and Port of Corpus Christi Inner Harbor (Inner Harbor).

3.8.1.1 Regional Water Issues and Trends

Water Use and Availability

The Coastal Bend region depends mostly on surface water sources for municipal and industrial (M&I) water supply. The principal surface water sources are the Choke Canyon/Lake Corpus Christi System (CCR/LCC System) in the Nueces River basin and the inter-basin transfers from Lake Texana on the Navidad River in Jackson County. Water quality in the region is generally good with some areas of concern regarding concentration of dissolved minerals, specifically in the Lower Nueces River and the Calallen Pool, where most of the region's water supply intakes occur (CBRWPG 2010).

Most M&I water is supplied by the City of Corpus Christi (205,000 acre-feet per year [AF/yr] in raw water contracts). Run of the river and small municipal water rights provide 8,603 AF/yr of reliable water. Year 2060 estimates of water available from all sources is 198,816 AF/yr (constrained by treatment plan capacities), of which 93 percent is provided by City of Corpus Christi supplies.

Total water demand is projected to increase from 205,936 AF in 2000 to 324,938 AF in 2060, an increase of 57.8 percent. M&I water demand is predominant among use categories, which is indicative of the projected (to 2060) population increase of 344,481 (63.7 percent) and substantial industrial growth centered on the Port of Corpus Christi. The Region N Water Planning Group noted that the industries in the Coastal Bend area are very efficient in their water use. State surveys of industrial water use show that petroleum refineries in the Coastal Bend area, for example, "use on the average 60 percent less water to produce a barrel of refined crude oil than refineries in the Houston/Beaumont area" (CBRWPG 2010).

Supply-Demand Comparisons

The Coastal Bend Region Water Planning Group (CBRWPG) (Region N) identified 18 cities and water user groups that would have unmet needs during drought of record supply conditions during the 60-year planning horizon from 2000–2060. Together, the Corpus Christi and San Patricio Municipal Water Districts supplied about 88 percent of the Region's water demands in 2000. The combined shortage in 2060 in the service areas of these two suppliers is projected to be 61,255 AF/yr. To meet these needs, the CBRWPG has recommended water management strategies that emphasize water conservation and maximization of available resources. Additional recommended strategies are identified that include off-channel reservoirs and pipelines, with a total estimated cost for all recommended strategies of $546,164,950. Alternative water management strategies developed as part of the planning process also included sea water and brackish groundwater desalination. The estimated social and economic impacts of failing to fully address these projected 2060 water shortages is over $7.8 billion in income and 55,000 fewer jobs in the Coastal Bend region. On the other hand, some recommended water management strategies, like M&I water conservation and wastewater reclamation, are likely to result in reduced freshwater return flows to bays and estuaries (CBRWPG 2010).

Compliance with Surface Water Quality Standards

TCEQ is required, under Sections 305(b) and 303(d) of the federal Clean Water Act (CWA), to prepare biennial statewide water quality assessments that identify the status of use attainment for water bodies, and to identify water bodies for which effluent limitations are not stringent enough to implement water quality standards. The TCEQ also develops a schedule identifying Total Maximum Daily Load (TMDL) studies that will be initiated in the next two years for priority impaired waters. The goals of TMDL projects are to: (1) determine the amount (load) of a pollutant a body of water can receive and still support its designated uses; (2) allocate this allowable load among all the potential sources of pollution within the watershed; and (3) implement measures to reduce pollutant loads as necessary (TCEQ 2010b). **Table 3.8-1** summarizes water quality assessment results from 1992 through 2010 for the four main water bodies that may be affected by the proposed build alternatives: Nueces River Tidal reach, Nueces Bay, Corpus Christi Bay, and the Inner Harbor.

The Texas Water Plan also addresses the human health and safety as well as ecosystem aspects of water resources planning, with an emphasis on compliance with the CWA, Safe Drinking Water Act (SDWA), and the Texas Water Quality Standards (TWQS). U.S. Geological Survey (USGS) studies show a substantial increase in the concentration of dissolved minerals in the Lower Nueces River between Lake Corpus Christi and the Calallen Saltwater Barrier Dam, where most of the Region's surface water is diverted. Median chloride concentrations at the Calallen Pool near the City of Corpus Christi's O.N. Stevens Water Treatment Plant intake (155 milligrams per liter [mg/L]) are nearly two times the chloride

Table 3.8-1 Texas Water Quality Assessment Results for Potentially Affected Waterbodies (1992–2010)				
Water Bodies/Segment Nos.[3]	**Nueces River Tidal Segment 2101**	**Corpus Christi Bay Segments 2481, 2481CB, and 2481 OW**	**Nueces Bay Segments 2482, 2482 NB, and 2482OW**	**Corpus Christi Inner Harbor Segment 2484**
Designated Uses	Aquatic Life Use – High Primary Contact Recreation Fish Consumption Use General Use	Aquatic Life Use – Exceptional Primary Contact Recreation Recreational Beaches Oyster Waters Use Fish consumption Use General Use	Aquatic Life Use – Exceptional Primary Contact Recreation Recreational Beaches Oyster Waters Use Fish consumption Use General Use	Aquatic Life Use – Intermediate Primary Contact Recreation Fish consumption Use General Use
Water Quality Assessment / 303(d) List and Use Support Concerns – by Year[4]				
1992 303(d) List	Not listed	**303(d)-listed** for fecal coliform and "some toxics" (on CWA 304(l) list of toxic concerns, but meeting toxics standards)	**303(d)-listed** for fecal coliform, low dissolved oxygen, and "some toxics" (on 304(l) list of toxic concerns, but meeting toxics standards)	Not listed
1994 303(d) List	Not listed	Not listed	**303(d)-listed**, pollutant or stressor not listed, TMDL priority undetermined	**303(d)-listed**, pollutant or stressor not listed, TMDL priority low
1996 303(d) List	Not listed	Not listed	**303(d)-listed** for fecal coliform; oyster waters use not supported at White Point, and partially supported in remainder of the bay	**303(d)-listed**, for dissolved copper exceeding criteria (Not Supporting), and depressed dissolved oxygen in Avery and Viola turning basins (partially supporting)

[3] Segments designated under TCEQ (or predecessor agencies) Texas Surface Water Quality Standards
[4] Source: TCEQ Section 305(b) Integrated Reports and Section 303(d) lists of impaired waters

Table 3.8-1 Texas Water Quality Assessment Results for Potentially Affected Waterbodies (1992–2010)				
Water Bodies/Segment Nos.[3]	**Nueces River Tidal Segment 2101**	**Corpus Christi Bay Segments 2481, 2481CB, and 2481 OW**	**Nueces Bay Segments 2482, 2482 NB, and 2482OW**	**Corpus Christi Inner Harbor Segment 2484**
Designated Uses	Aquatic Life Use – High Primary Contact Recreation Fish Consumption Use General Use	Aquatic Life Use – Exceptional Primary Contact Recreation Recreational Beaches Oyster Waters Use Fish consumption Use General Use	Aquatic Life Use – Exceptional Primary Contact Recreation Recreational Beaches Oyster Waters Use Fish consumption Use General Use	Aquatic Life Use – Intermediate Primary Contact Recreation Fish consumption Use General Use
Water Quality Assessment / 303(d) List and Use Support Concerns – by Year[4]				
1998 Assessment and 303(d) List	Not listed	**303(d)-listed** for microbial contamination; based on Texas Department of State Health Services (TDSHS) shellfish maps, 13% of bay is not supporting oyster water use	**303(d)-listed** for zinc in oyster tissue; based on TDSHS shellfish maps, 100% of bay is not supporting oyster water use	**303(d)-listed** for depressed dissolved oxygen in Avery and Viola turning basins (partially supporting, low priority); removed dissolved copper as parameter for listing; insufficient data to support listing for zinc
1999 303(d) List	Not listed	**303(d)-listed** for human pathogens contamination; based on TDSHS shellfish maps, 13% of bay is not supporting oyster water use	**303(d)-listed** for zinc in oyster tissue; based on TDSHS shellfish maps, 100% of bay is not supporting oyster water use	Not listed; de-listed based on data showing dissolved oxygen levels supporting aquatic life use throughout the waterbody
2000 Assessment and 303(d) List	Not listed	**303(d)-listed** for human pathogens contamination; based on TDSHS shellfish maps, 13% of bay is not supporting oyster water use	**303(d)-listed** for zinc in oyster tissue; based on TDSHS shellfish maps, 100% of bay is not supporting oyster water use	Not listed
2002 Assessment and 303(d) List	Not listed; excessive algal growth/ chlorophyll-A levels noted as water quality concern	Not listed; de-listed because original basis for bacterial impairment was inaccurate; further evaluation of TDSHS basis for oyster waters use restriction determined that restriction is risk-	**303(d)-listed** for zinc in oyster tissue; based on TDSHS shellfish maps, entire waterbody is not supporting oyster water use	Not listed Nutrient enrichment concern (ammonia and nitrogen) noted in area near Avery and Viola turning basins and Navigation Blvd

Table 3.8-1 Texas Water Quality Assessment Results for Potentially Affected Waterbodies (1992–2010)				
Water Bodies/Segment Nos.[3]	**Nueces River Tidal Segment 2101**	**Corpus Christi Bay Segments 2481, 2481CB, and 2481 OW**	**Nueces Bay Segments 2482, 2482 NB, and 2482OW**	**Corpus Christi Inner Harbor Segment 2484**
Designated Uses	Aquatic Life Use – High Primary Contact Recreation Fish Consumption Use General Use	Aquatic Life Use – Exceptional Primary Contact Recreation Recreational Beaches Oyster Waters Use Fish consumption Use General Use	Aquatic Life Use – Exceptional Primary Contact Recreation Recreational Beaches Oyster Waters Use Fish consumption Use General Use	Aquatic Life Use – Intermediate Primary Contact Recreation Fish consumption Use General Use
Water Quality Assessment / 303(d) List and Use Support Concerns – by Year[4]				
		based, not water quality based		
2004 Assessment and 303(d) List	Not listed; excessive algal growth noted as water quality concern	Not listed; oyster waters use concern noted for bacteria	**303(d)-listed** for zinc in oyster tissue; based on TDSHS shellfish maps, entire waterbody is not supporting oyster water use	Not listed Nutrient enrichment concern (ammonia and nitrogen) noted in area near Avery and Viola turning basins and Navigation Boulevard
2006 Assessment and 303(d) List	Not listed	Not listed	Not listed; de-listed because a TMDL addressing the use impairment of zinc in oyster tissue was developed and approved by EPA; entire waterbody assessed as not supporting oyster water use	Not listed Nutrient enrichment concern; ammonia levels above nutrient screening levels

Table 3.8-1 Texas Water Quality Assessment Results for Potentially Affected Waterbodies (1992–2010)				
Water Bodies/Segment Nos.[3]	**Nueces River Tidal Segment 2101**	**Corpus Christi Bay Segments 2481, 2481CB, and 2481 OW**	**Nueces Bay Segments 2482, 2482 NB, and 2482OW**	**Corpus Christi Inner Harbor Segment 2484**
Designated Uses	Aquatic Life Use – High Primary Contact Recreation Fish Consumption Use General Use	Aquatic Life Use – Exceptional Primary Contact Recreation Recreational Beaches Oyster Waters Use Fish consumption Use General Use	Aquatic Life Use – Exceptional Primary Contact Recreation Recreational Beaches Oyster Waters Use Fish consumption Use General Use	Aquatic Life Use – Intermediate Primary Contact Recreation Fish consumption Use General Use
Water Quality Assessment / 303(d) List and Use Support Concerns – by Year[4]				
2008 Assessment and 303(d) List	Not listed Chlorophyll-A above nutrient screening levels noted as water quality concern	Not listed	Not listed; has approved TMDL addressing the use impairment of zinc in oyster tissue was developed and approved by EPA; entire waterbody assessed as Not Supporting Oyster Water Use	Not listed Nutrient enrichment concern; ammonia, nitrate and chlorophyll-A above nutrient screening levels

Table 3.8-1 Texas Water Quality Assessment Results for Potentially Affected Waterbodies (1992–2010)				
Water Bodies/Segment Nos.[3]	**Nueces River Tidal Segment 2101**	**Corpus Christi Bay Segments 2481, 2481CB, and 2481 OW**	**Nueces Bay Segments 2482, 2482 NB, and 2482OW**	**Corpus Christi Inner Harbor Segment 2484**
Designated Uses	Aquatic Life Use – High Primary Contact Recreation Fish Consumption Use General Use	Aquatic Life Use – Exceptional Primary Contact Recreation Recreational Beaches Oyster Waters Use Fish consumption Use General Use	Aquatic Life Use – Exceptional Primary Contact Recreation Recreational Beaches Oyster Waters Use Fish consumption Use General Use	Aquatic Life Use – Intermediate Primary Contact Recreation Fish consumption Use General Use
Water Quality Assessment / 303(d) List and Use Support Concerns – by Year[4]				
2010 Assessment and 303(d) List	Not listed Chlorophyll-A above nutrient screening levels noted as water quality concern	**303(d)-listed**, Segment 2481CB (Recreational Beaches at Cole Park and Ropes Park) for bacterial contamination Concern (near non-attainment of WQ standards) for bacterial contamination noted for: McGee Beach, Poenisch Park, and Emerald Beach; (Not Listed for other uses and other segment IDs of Corpus Christi Bay)	Not listed; Segment 2482OW has approved TMDL addressing the use impairment of zinc in oyster tissue was developed and approved by EPA; entire waterbody assessed as Not Supporting Oyster Water Use; Concern (near non-attainment of WQ standards) for bacterial contamination noted for Nueces Bay Causeway # 3 area of Segment 2482NB (Not listed for other uses in Nueces Bay or for Segment 2482)	Not listed Nutrient enrichment concern; ammonia and nitrate above nutrient screening levels

concentrations in water released from Lake Corpus Christi (80 mg/L). Sources include saltwater intrusion, groundwater seepage, and upstream sources of contamination from abandoned wells in adjacent oil fields and gravel washing operations. These high dissolved solids concentrations result in increased industrial water demands due to accelerated buildup of minerals in industrial cooling facilities, as well as high levels of chlorides and bromides in the water supply, which periodically exceed drinking water standards. Since such a large portion of the region's water demand is for industrial use, improvements in water quality can result in reduced levels of industrial consumption and ensured compliance with SDWA requirements without expensive treatment methods (CBRWPG 2010).

Estuarine and Ecosystem Water Quality Management Issues

The Coastal Bend Bays and Estuary Program (CBBEP) has sponsored a planning process, called the *Nueces Estuary Ecosystem Management Initiative,*[5] that assesses the relative values of and potential threats to the Nueces Estuary system (CBBEP 2011). Based on a combination of scientific analysis and stakeholder input, the plan identifies the "ecosystem services" provided by eleven dominant habitat types. Examples of ecosystem services include nutrient cycling, habitat for resident and migratory species, soil retention, flood control, freshwater supply, recreation and aesthetic values, and many others. Priority habitats identified by stakeholders included seagrass beds, salt marsh wetlands, intertidal flats, marine-open water, scrub-shrub wetlands, and freshwater wetlands. By establishing a system for quantifying the contributions of ecological resources, the planning process is intended to aid decision makers in evaluating trade-offs between development goals and key ecosystem values. Water quality is cited as a prominent example of an "umbrella" ecosystem service, one which encompasses other services, such as nutrient regulation, waste regulation, soil retention, and even recreation and aesthetics.

Current and Future Threats and Risks to Ecological Resources

The planning process identified both natural and anthropogenic (manmade) threats and risks to these above-mentioned habitats. The study concluded that, among natural risks, invasive species represent the main biological threat. There are currently 88 documented invasive plant species in Nueces, San Patricio, and Aransas Counties. Invasive marine species[6] can come from ship hulls and ballast water.

[5] CBBEP has supported the Harte Research Institute for Gulf of Mexico Studies and Texas A&M—Corpus Christi in developing the multi-phased Nueces Estuary Ecosystem Management Initiative, under the direction of Paul A. Montagna, Ph.D. CBBEP conservation activities extend to the Nueces River and Delta; Nueces Bay; Corpus Christi Bay; Redfish and South Aransas Bays; Mustang and North Padre Islands; Upper Laguna Madre; Oso Bay; and Oso Creek.

[6] TPWD maintains a list of invasive species (http:www.texasinvasives.org/invasives database/) which does not at present include marine species. The lack of comprehensive data on invasive marine species and their effects on estuarine and coastal ecosystems led the ecosystems management plan to treat the threat as unknown or a data gap.

Other natural threats to ecosystem resources include climate anomalies such as tropical storms, hurricanes, droughts, floods, freezes, sea level rise and shoreline change.[7]

Among anthropogenic threats to the ecosystem, development and related pollution were ranked the most important. Examples include zinc levels in Nueces Bay; hypoxia (low dissolved oxygen) in Oso Creek, Oso Bay and Corpus Christi Bay;[8] and high levels of bacteria at Ropes and Cole Parks on Corpus Christi Bay. Stormwater runoff is an issue of concern throughout the project study area because it can load the receiving waters with various development-related pollutants, including oil and grease from roadways; fertilizers, herbicides and pesticides from residential homes; and industrial pollutants from industries adjacent to the bay (CBBEP 2011). A study of non-point source pollution in Corpus Christi Bay by Carr et al. (2000) noted that four of the five most degraded sites identified were stormwater outfall sites.

Atmospheric Deposition

Another substantial source of water quality problems in Corpus Christi area bays and estuaries is atmospheric deposition of nutrient nitrogen and organic contaminants. Excessive levels of nutrients such as nitrogen in coastal waters have resulted in a wide variety of water quality and biological problems, such as red tides, fish kills, and loss of sea grass habitats, among others. Studies performed through the CBBEP in cooperation with the National Atmospheric Deposition Program have confirmed that atmospheric deposition is an important source of nutrient nitrogen, trace element, and organic contaminants to Coastal Bend bays; in fact, 46 percent of the nutrient nitrogen entering the bays was found to come from atmospheric sources (Wade and Sweet 2008).

3.8.1.2 Nueces River and Delta

Existing Conditions

The Nueces River and its on-channel reservoirs Lake Corpus Christi and Choke Canyon Reservoir provide drinking water for Corpus Christi and the surrounding Coastal Bend area. These reservoirs control almost all the flow from the Nueces River and regulate freshwater inflow into the Nueces Estuary. The Nueces River supports palustrine (freshwater) emergent marshes and forested wetlands. This sub-region contains the largest expanse of freshwater wetlands in the Nueces Bay Ecosystem planning area.

[7] For example, the recurring brown tide events in the Laguna Madre in the 1990s are attributed to a combination of ecological factors initiated by persistent drought followed by back-to-back extended freezes (CBBEP 2011, xvi).

[8] Hypoxia in Corpus Christi Bay occurs in bottom waters and is therefore not included on TCEQ's 303(d) list of impaired waters, which monitors surface water quality (CBBEP 2011, 17).

Extensive estuarine emergent wetlands can be found on the Nueces River Delta and at the mouth of the Nueces River. Tidal mats and algal mats are also extensive on the Delta (CBBEP 2011).

Water Quality Issues and Trends

Both palustrine and, to a lesser extent, estuarine marsh habitats experienced decline in the Delta from the 1950s to 2004. High chloride concentrations have been measured in the river upstream of the Calallen Dam (CBRWPG 2010). Due to concern about excessive algal growth and elevated levels of chlorophyll-a, the Nueces River Tidal (Segment 2101) was included on TCEQ's 2010 Integrated Report list of Water Bodies with Concerns for Use Attainment and Screening Levels (TCEQ 2011b). This concern over excessive algal growth was also noted in the 2002, 2004, and 2008 statewide water quality assessments (see **Table 3.8-1**). Priority concerns identified by stakeholders in the ecosystem planning process included protection of Gum Hollow Creek (including the Delta), protection of freshwater inflows, preservation of freshwater and salt marsh wetlands, and erosion control (CBBEP 2011).

3.8.1.3 Nueces Bay

Existing Conditions

Nueces Bay encompasses an area of 28.9 square miles and drains the Nueces River Basin (16,950 square miles), along with portions of the San Antonio-Nueces and Nueces-Rio Grande Coastal Basins. Nueces Bay is a shallow, secondary bay that receives freshwater from the Nueces River and exchanges saline water with Corpus Christi Bay. The Nueces Bay watershed includes the bay and a large area of mostly agricultural land north of the bay, as well as the area between the Inner Harbor and the Nueces Bay. Habitats along the north shore of the bay include seagrass beds, habitat for redhead ducks, and estuarine emergent wetlands. Nueces Bay also contains the largest extent of oyster reefs in the area. There are four permitted wastewater treatment plant outfalls into Nueces Bay. The area surrounding Sunset Lake along the shoreline north of the Nueces Bay Causeway, including Indian Point, is a high priority ecosystem services area.

Water Quality Issues and Trends

Nueces Bay (Segment 2842) was listed as an impaired waterbody on the 303(d) List from 1992 through 2004 for fecal coliform, low dissolved oxygen, and/or zinc in oyster tissue. Low Dissolved Oxygen was noted as a reason for 303(d) listing in 1992 only, and fecal coliform was noted in 1992 and 1996. Zinc in oyster tissues was the basis of 303(d) lists from 1998 through 2004. From 2006 through the present, Nueces Bay has been considered impaired for the zinc contaminate of oyster tissue, although it is not on the 303(d) List due to having an approved TMDL that addresses the impairment.

Monitoring data collected by the Texas Department of State Health Services (TDSHS) for oyster tissue in all Texas bays since 1969 show that Nueces Bay had the highest level of zinc in oysters in the state. Average concentration from 1980 to 2005 was 1409 milligram per kilogram [mg/kg], more than the

Health-based Assessment Comparison (HAC) value of <700 mg/kg (the target concentration for zinc in oyster tissue that must be achieved). From 1942 to 1985, ASARCO operated a zinc smelting facility that discharged effluent along the southwestern shoreline of Nueces Bay and to the Inner Harbor. According to TCEQ, "[s]everal billion tons of zinc ore were processed during that time and [are] believed to be the cause of zinc that still remains today" (2006).

TCEQ initiated a TMDL study in 2002. DSHS conducted a quantitative risk characterization and collected oyster tissue from two sites, one just north of the Nueces Bay Causeway (on US 181) and the other near the Nueces Bay Power Station (NBPS) on the Inner Harbor. The average zinc concentrations in oyster tissue collected in 2002 at the causeway and NBPS sites were 661 mg/kg and 1,486 mg/kg, respectively. The TMDL study was completed and approved by TCEQ in November 2006 and by EPA in December 2006. The study concluded that "[l]egacy zinc in sediment resulting from historic smelting activities is the primary source of this pollutant." The study also concluded that "the zinc in water from the Inner Harbor is the second leading source of zinc loadings to Nueces Bay via the NBPS." NBPS' wastewater permit allows withdrawal of 500 million gallons per day (MGD) from the Inner Harbor for use as once-through cooling water and discharge into Nueces Bay. TCEQ's TMDL study stated that the NBPS "in essence acts as a conduit for the transfer of large amounts of zinc from the Inner Harbor to Nueces Bay." In January 2003, American Electric Power (AEP), owner of the NBPS facility, notified TCEQ that it would place the NBPS "on long-term mothball status" but would keep the wastewater permit in active status (TCEQ 2006). The TMDL study concluded that sediment zinc concentrations in Nueces Bay should continue to decline provided that large-scale disturbances are minimized in the Inner Harbor. "As long as the total zinc concentration in the water column remains well below the 29 µ/L criteria in the Inner Harbor, zinc levels in the oyster tissue in the Bay should attenuate to below the target HAC value of <700 mg/kg. Therefore, it is anticipated that if zinc concentrations are maintained at existing levels under the current conditions the oyster water use will be restored to Nueces Bay" (TCEQ 2006). The Nueces Bay TMDL Implementation Plan was adopted by the TCEQ in October 2007. The Implementation Plan recommends continued sampling to track attenuating zinc levels in Nueces Bay.

There is one recreational beach area within the Nueces Bay Segment 2482NB, known as the Nueces Bay Causeway No. 3 area, which is on the TCEQ's 2010 Integrated Report list of Water Bodies with Concerns for Use Attainment and Screening Levels (TCEQ 2011b) due to near non-attainment of water quality standards for bacteria.

Nueces Bay has experienced considerable loss of tidal flat and marsh habitats in the past decades. The shoreline north of the Nueces River and along the Tule Lake Channel has been highly modified by development, with losses of tidal flat habitat north of the Tule Lake Channel caused by infilling. Loss of marsh habitat at Indian Point north of the causeway and along the adjacent shoreline has resulted from erosion and sea level rise. Priority concerns about Nueces Bay identified by stakeholders were the areas mentioned above as well as the Port of Corpus Christi. The CBBEP has undertaken a marsh restoration program for Nueces Bay (CBBEP 2011).

3.8.1.4 Corpus Christi Bay

Existing Conditions

Corpus Christi Bay contains nine priority habitat types, including estuarine emergent wetlands and seagrasses along the northern shoreline. Oyster reefs and flats also occur along the bay shores. Fourteen permitted entities maintain discharge permits along the northern bay shore.

Water Quality Issues and Trends

Corpus Christi Bay Recreational Beaches (Segment 2481CB) is listed as threatened/impaired for bacteria on the 2010 303(d) List for two of its recreational beaches, Cole Park and Ropes Park, which are located within five miles of the proposed project. Three other Corpus Christi Bay recreational beaches were included in the 2010 Integrated Report for Water Bodies with Concerns for Use Attainment due to near non-attainment of water quality standards for bacteria: McGee Beach, Poenisch Park, and Emerald Beach (TCEQ 2011b). Other priority water quality issues in Corpus Christi Bay (TSWQS Segment 2481) include hypoxia and bacteria. Tidal flat habitat losses are occurring along the Tule Lake Channel and at Indian Point. Indian Point has also lost estuarine flat habitat and to a lesser degree marsh habitat since the 1950s. These losses have been attributed to sea-level rise and erosion. Tidal flats are extensive on the spoil islands in the bay. Texas Parks and Wildlife's (TPWD's) Seagrass Conservation Plan indicates that seagrass bed distribution in Corpus Christi Bay is stable; however, the plan has not been substantially updated since 1999 and is currently under revision (CBBEP 2011).

3.8.1.5 Corpus Christi Inner Harbor

Existing Conditions

The Port of Corpus Christi Authority maintains the Inner Harbor Placement Area 1 (IH-PA 1), which is an upland confined placement area (UCPA) covering approximately 350 acres north of the Inner Harbor and west of the existing US 181 alignment. Since the (IH-PA 1) is the principal disposal area for maintenance dredging for the Inner Harbor, the current and historic conditions of water and sediment quality in both the Inner Harbor and the (IH-PA 1) are relevant.

These resources are addressed in the FEIS prepared by the USACE Galveston District for the proposed Corpus Christi Ship Channel Improvement Project (USACE 2003), which would include dredging the Inner Harbor from its current depth of 45 feet to a depth of 52 feet, among other improvements. Water and sediment quality data collected at regular intervals by the USACE in all reaches of the proposed channel were reviewed and compared with Texas Water Quality Standards, along with elutriate samples, which provide information on constituents that are dissolved into the water column during dredging and placement. Metals found above detection limits in water and elutriate samples included arsenic, barium, cadmium, chromium, copper, nickel, and zinc. Sediment samples were analyzed for polycyclic aromatic hydrocarbons (PAHs), organochlorine compounds, polychlorinated biphenyls (PCBs), and trace

elements, and compared with the Effects Range Low standards (ERLs). The USACE found that there were exceedances of the ERLs in the Inner Harbor. For most metals in most of the system, including the Inner Harbor, concentrations are declining (USACE 2003).

Due to concerns about contaminants, maintenance materials dredged from the Inner Harbor are recommended by the USACE to be placed in the existing UCPA. Sampling of any future project maintenance material will be routinely conducted to determine sediment quality prior to actual dredging (USACE 2003).

In 2003, the USACE found that the detection of constituents of concern and the number of exceedances were prevalent in the Inner Harbor, compared with other reaches of the channel project. Since all material from this reach will be placed in UCPAs, the elutriates are of key interest, as they most nearly represent the discharge of stormwater draining from the UCPAs (USACE 2003). However, the USACE also noted that the elutriate analysis performed for the FEIS showed no indications of concerns. The decant water discharged from the UCPA would return to the Inner Harbor as drainage.

Water Quality Issues and Trends

The Inner Harbor was 303(d)-listed in 1996 and 1998 for dissolved oxygen in Avery and Viola turning basins (Partially Supporting). It was de-listed in 1999 based on data showing dissolved oxygen levels supporting Aquatic Life Use throughout the waterbody. From 2000 through 2006, the Inner Harbor was not listed, but concerns about nutrient enrichment (ammonia and nitrogen) were noted in the areas near Avery and Viola turning basins and Navigation Boulevard. Similar concerns about nutrient enrichment (ammonia and nitrate above nutrient screening levels) throughout the waterbody were included in the 2008 and 2010 Integrated Reports. The Nueces Bay TMDL project (discussed in **Section 3.8.1.3**) also addressed the issue of zinc concentrations in Inner Harbor, finding that "legacy" contaminants in the Inner Harbor are expected to attenuate over time, and that sediment zinc concentrations in Nueces Bay should continue to decline provided that large-scale disturbances are minimized in the Inner Harbor (TCEQ 2006).

3.8.2 Groundwater Availability and Quality

3.8.2.1 Coastal Bend Region

Inland areas within the TWDB Coastal Bend Regional Planning Area (Region N) are dependent on groundwater. There are two major aquifers—Gulf Coast and Carrizo-Wilcox—and two minor aquifers in the region (see **Figure 3.8-1**). The Gulf Coast aquifer yields moderate to large amounts of fresh and slightly saline water. The Carrizo-Wilcox occurs only under parts of McMullen, Live Oak, and Bee Counties. Neither aquifer extends into the coastal zone or the proposed project area, where the available groundwater is brackish. However, longer term water development strategies recommended by the Region N Water Planning Group may involve groundwater projects to address potential 2030 and 2060 water shortages in Corpus Christi and other coastal communities (CBRWPG 2010).

As stated previously, total water demand in the Coastal Bend Region is projected to increase from 205,936 AF in 2000 to 324,938 AF in 2060, an increase of 57.8 percent. Increases are predicted in all water use categories except livestock use. Combined reliable yields from the region's two major and two minor aquifers amount to about 109,351 AF/yr, with projected use of 81,426 AF/yr if recommended water management strategies are implemented. Groundwater Management Areas in the region are working with TWDB to determine desired future conditions (CBRWPG 2010).

Statewide and regional groundwater quality issues are addressed in the 2010 Texas Groundwater Assessment.[9] This report identified nitrate contamination as an issue of statewide concern, particularly associated with atmospheric deposition, natural sources, inorganic fertilizer organic fertilizer or manure, concentrated animal feeding operations, barnyards, septic tanks, and leaking sewer systems. The Ogallala and Gulf Coast aquifers were identified as areas of concern for nitrates. High levels of nitrate, arsenic, and radionuclides were identified in Gulf Coast aquifer wells, primarily in the southern coastal plain counties of Jim Wells, Duval, Brooks, Jim Hogg, Starr, and Hidalgo (TCEQ 2010b).

3.8.2.2 Water Wells

Though no appreciable freshwater sources exist within the vicinity of the proposed project, several water and oil and gas wells have been drilled in the vicinity. These wells are listed below in **Table 3.8-2**.

Table 3.8-2 Groundwater, Oil and Gas Wells Within the Proposed Project Area

Well #	Type	Use	Location	
			Latitude	Longitude
25013	Water	Monitoring	27.4810	-97.2520
34510	Oil/Gas	Dry Hole	27.8226	-97.3925
34719	Oil/Gas	Dry Hole	27.8212	-97.4123
34723	Oil/Gas	Dry Hole	27.8028	-97.4071

Source:
Texas Water Development Board (TWDB). 2012. WIID System. http://wiid.twdb.state.tx.us/index_explain.asp
Accessed September 14, 2012
Railroad Commission of Texas. 2012. Digital Map Data including API Data for Nueces and San Patricio Counties. Ordered from http://www.rrc.state.tx.us/data/datasets/DigitalMapData.php

[9]The Groundwater Assessment is an annual review of statewide and regional groundwater quality issues based on monitoring and contamination data collection by TCEQ, TWDB, groundwater districts, and other entities. The assessment is compiled by the Texas Groundwater Protection Committee (TGCP), which was created by the Texas 71st Legislature in 1989 to coordinate water quality protection and other activities among 10 State agencies or organizations that have responsibility for groundwater-related programs.

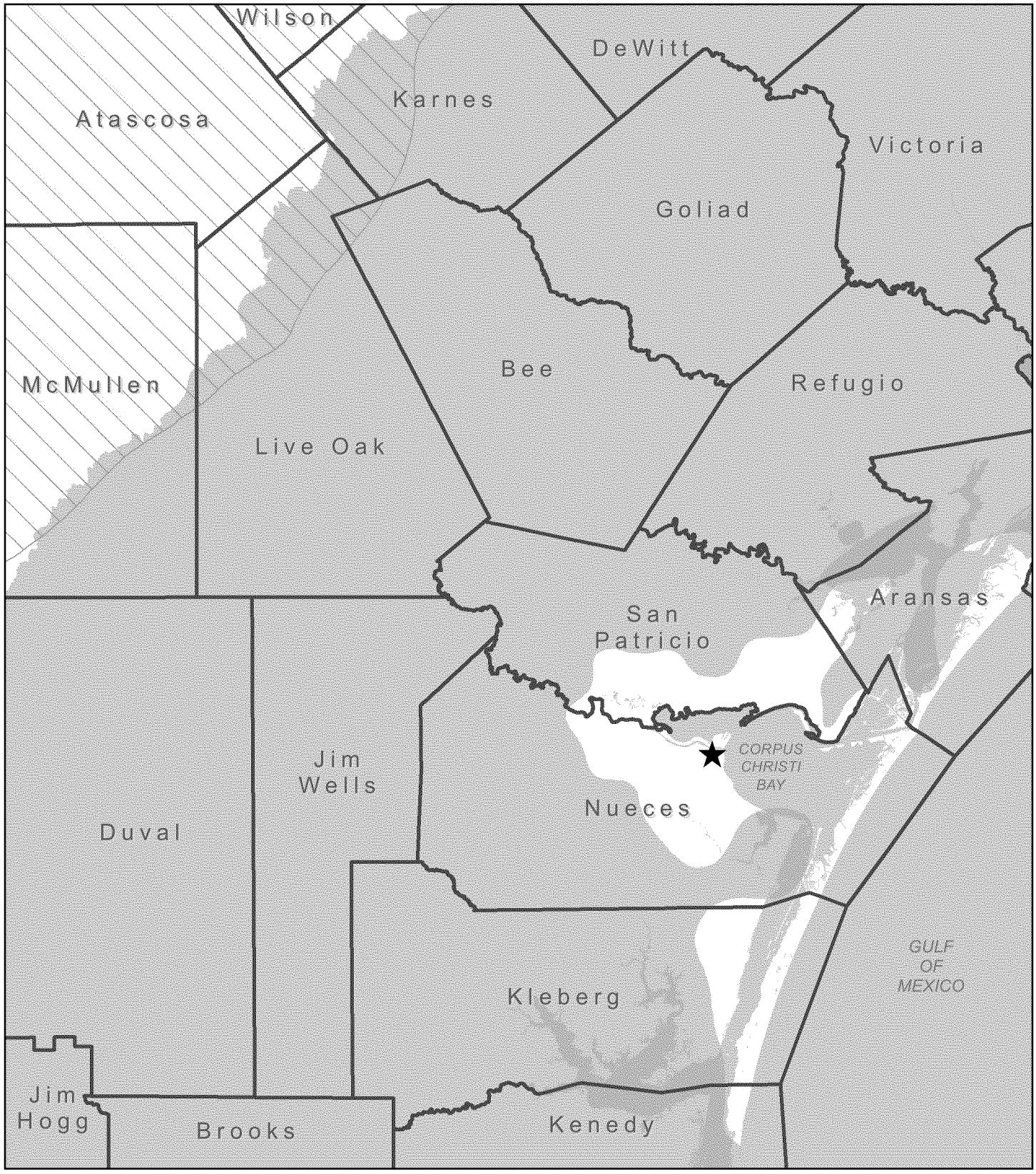


Figure 3.8-1

US 181 Harbor Bridge
Major and Minor Aquifers

This page intentionally blank

3.8.3 Texas Pollutant Discharge Elimination System

Section 402 of the CWA regulates discharge of any pollutants to waters of the U.S. This not only regulates point-source discharges but also non-point source discharges such as stormwater runoff from construction sites. The State of Texas has received authority from the EPA to administer Section 402 of the CWA. To accomplish this, the TCEQ developed the Texas Pollutant Discharge Elimination System (TPDES) program to regulate point and non-point sources of water pollution.

The CBBEP Nueces Estuary Ecosystem Management Initiative identified a total of 47 domestic and industrial wastewater point source discharge permits for the Corpus Christi Bay area. These include both major category permits, which allow greater than one million gallons per day of discharge; minor permits, which allow less than one million gallons per day of discharge; and intermittent and flow variable permits. There are a total of 16 domestic wastewater treatment facilities with the Corpus Christi Bay area, 11 of which are major category permits and five of which are minor category permits. Industrial permitted facilities number at 31 in the Corpus Christi Bay area, with 13 major category permits, 12 minor category permits, and 6 intermittent and flow variable permits (CBBEP 2011, 150).

Congress amended the CWA in 1987 to require the EPA to establish phased NPDES requirements for stormwater discharges. To implement these requirements, on November 16, 1990, EPA published (55 Federal Register 47990) the initial permit application requirements for 11 categories of stormwater discharges associated with industrial activity, as well as discharges from municipal separate storm sewer systems (MS4) located in municipalities with a population of 100,000 or more. The MS4 requirements effectively prohibit non-stormwater discharges (including construction activities) into the storm sewers. The CWA also requires NPDES permits for discharges from an MS4 to include controls to reduce the discharge of pollutants to the maximum extent practicable by implementation of management practices, control techniques, engineering methods, and other provisions appropriate for the control of such pollutants.

In response to the EPA municipal stormwater permit requirements, the City of Corpus Christi, Texas Department of Transportation-Corpus Christi District, Corpus Christi Junior College District, Port of Corpus Christi Authority, and Texas A&M University–Corpus Christi submitted a Joint Part 1 permit application to EPA in May 1992 and Joint Part 2 application to EPA in May 1993 (City of Corpus Christi 2012).

The City of Corpus Christi and its co-permittees were issued NPDES permit No. TXS000601 in April 1995, which became effective on June 1, 1995, and was renewed as TPDES Permit No. WQ0004200000. The permit provides the opportunity to propose appropriate management programs to control pollutants in discharges. One of the management programs required by EPA is to implement and maintain structural and non-structural best management practices to reduce pollutants in stormwater runoff from flood management projects (City of Corpus Christi 2012).

Large transportation construction projects typically receive permit coverage under the TPDES General Construction Permit (CGP) TXR150000, which covers non-point sources of stormwater discharge from construction sites. Under this CGP any project that disturbs more than one acre (including all staging areas, access roads, bridge abutment and pier shaft sites, and the at-grade portion of the roadway itself) or is part of a phased plan that will disturb more than one acre must comply with the requirements of the CGP, including the preparation of a Stormwater Pollution Prevention Plan (SW3P) to demonstrate best management practices (BMPs) during construction.

3.8.4 General Bridge Act of 1946 and River and Harbors Act of 1899

The Rivers and Harbors Act of 1899 defines navigable waters as "those waters that are subject to the ebb and flow of the tide and/or are presently used, or may have been used in the past, or may be susceptible for use to transport interstate or foreign commerce." Section 9 of the Rivers and Harbors Acts (superseded by the General Bridge Act of 1946) grants the United States Coast Guard (USCG) regulatory authority over the construction of bridges and causeways within or across navigable waters of the U.S. Additionally, Section 10 grants the USACE regulatory authority over work conducted on structures within or affecting the course, condition, or capacity of navigable waters.

The proposed project would include the rehabilitation or replacement of the Harbor Bridge over a navigable water of the U.S. as defined by the Rivers and Harbors Act; therefore, coordination with the USCG and USACE would be required under Sections 9 and 10, respectively.

3.8.4.1 Section 9 Permit – USCG

The Eighth District of the USCG issues Section 9 permits and has an application process in place. TxDOT would follow the guidelines provided by the USCG Bridge Program in the Office of Bridge Programs, USCG Bridge Permit Application Guide. Since the project is within the Texas Coastal Management Plan (CMP) boundaries, it will be necessary to forward the Section 9 application to the Texas Coastal Coordination Council (CCC) to get a consistency determination before the USCG will publish a public notice for a proposed permit (see **Section 3.8.4** for further discussion of the Coastal Zone Management Program). A joint public notice would be issued by the USCG and TCEQ to cover Section 401 Water Quality certification requirements for the Section 9 permit.

3.8.4.2 Section 10 Permit – USACE

A navigability determination is required as part of the pre-application process with USACE. Navigability determinations (definitions vary between the regulations) also fall within the jurisdiction of USACE for any permit associated with a bridge project requiring a Section 10 permit from USACE.

3.8.5 Coastal Zone Management Program

Section 306 of the Federal Coastal Zone Management Act of 1972 allows coastal states to submit for approval of state coastal management plans. Approval of these state plans makes the state eligible for federal grant funds for coastal issues and enables the state to review federal actions and permits for consistency with the coastal plan. Texas has an approved CMP, which was developed and adopted and is currently being implemented by the CCC. The CCC is charged with making more effective and efficient use of public funds and providing for more effective and efficient management of coastal natural resources. Under the CMP, agency actions that are within the coastal boundaries and subject to the CMP must comply with the CMP's applicable goals and policies.

The proposed project is located within Nueces County, which is within the Texas CMP Boundary as defined in §503.1 of Title 31 in the Texas Administrative Code (TAC) (see **Figure 3.8-2**). Therefore, a consistency determination would be required to maintain compliance with the CMP. This determination would be included in the Section 9 USCG and Section 404/10 USACE permitting processes.

3.8.6 Coastal Barrier Resources Act

The Coastal Barrier Resources Act (CBRA) was enacted in 1982 to protect coastal barriers along the Atlantic and Gulf coasts from development by making these designated areas ineligible for financial assistance from the federal government. The CBRA was reauthorized in 1990 with the passage of the Coastal Barrier Improvement Act and expanded to include the Florida Keys, Great Lakes, Puerto Rico, and the U.S. Virgin Islands.

The proposed project is located within Nueces County but is not located within a designated CBRA map unit (see **Figure 3.8-3**); therefore, CBRA coordination with the U.S. Fish and Wildlife Service (USFWS) would not be required.

3.8.7 State-owned Submerged Lands

The State of Texas typically owns all areas along its coastal shoreline that extend from the mean high tide line to 10.36 miles offshore into the Gulf of Mexico. These areas are known as submerged lands and are regulated by the Texas General Land Office (GLO). Submerged lands in the vicinity of the proposed project are associated with the wetland observation area adjacent to Rincon Channel and northwest of US 181 (see **Figure 3.8-4**). However, this submerged area is owned jointly by the City of Corpus Christi and the CBBEP and not the GLO. Therefore, coordination with the GLO would not be required in regards to State-owned Submerged Lands. TxDOT will coordinate with the City and CBBEP for potential impacts to the wetland observation area as a 4(f) property (see **Section 3.15**).

3.9 FLOODPLAINS

3.9.1 Regulatory Overview

Executive Order 11988 "Floodplain Management" requires federal agencies to avoid actions, to the extent practicable, which would result in development within floodplains and/or affect floodplain values. Floodplains in the vicinity of the proposed project may be classified according to the Federal Emergency Management (FEMA) zones A, AE, X, and X500, which are relevant to the flood insurance program and are defined based on the probability of flooding. The 100-year flood elevations and flood depths provided on Flood Insurance Rate Maps (FIRMs), where available, establish the minimum regulatory elevations applicable to local floodplain management ordinances. Zones A and AE generally correspond to the areas subject to a 100-year flood event. Zone A is defined by FEMA as areas with a one percent annual chance of flooding. Additionally, Zone A designations are considered approximations where detailed analyses have not been performed, thus no depths or base flood elevations are shown within these zones. Zone AE designates areas with a one percent annual chance of flooding where the base flood elevations have been determined. Zone X defines areas of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. Zone X500 generally refers to areas subject to a 500-year flood event. Typical floodplains found along rivers, creeks, and streams are generally classified as Zones A and AE. FEMA requires an engineering study that demonstrates a project's effect on floodplains. If the project would result in an increase in the base flood elevation of one foot or more, or if it encroaches on a regulatory floodway, project engineers would be required to notify the affected National Flood Insurance Program (NFIP) participants.

3.9.2 Floodplain Areas

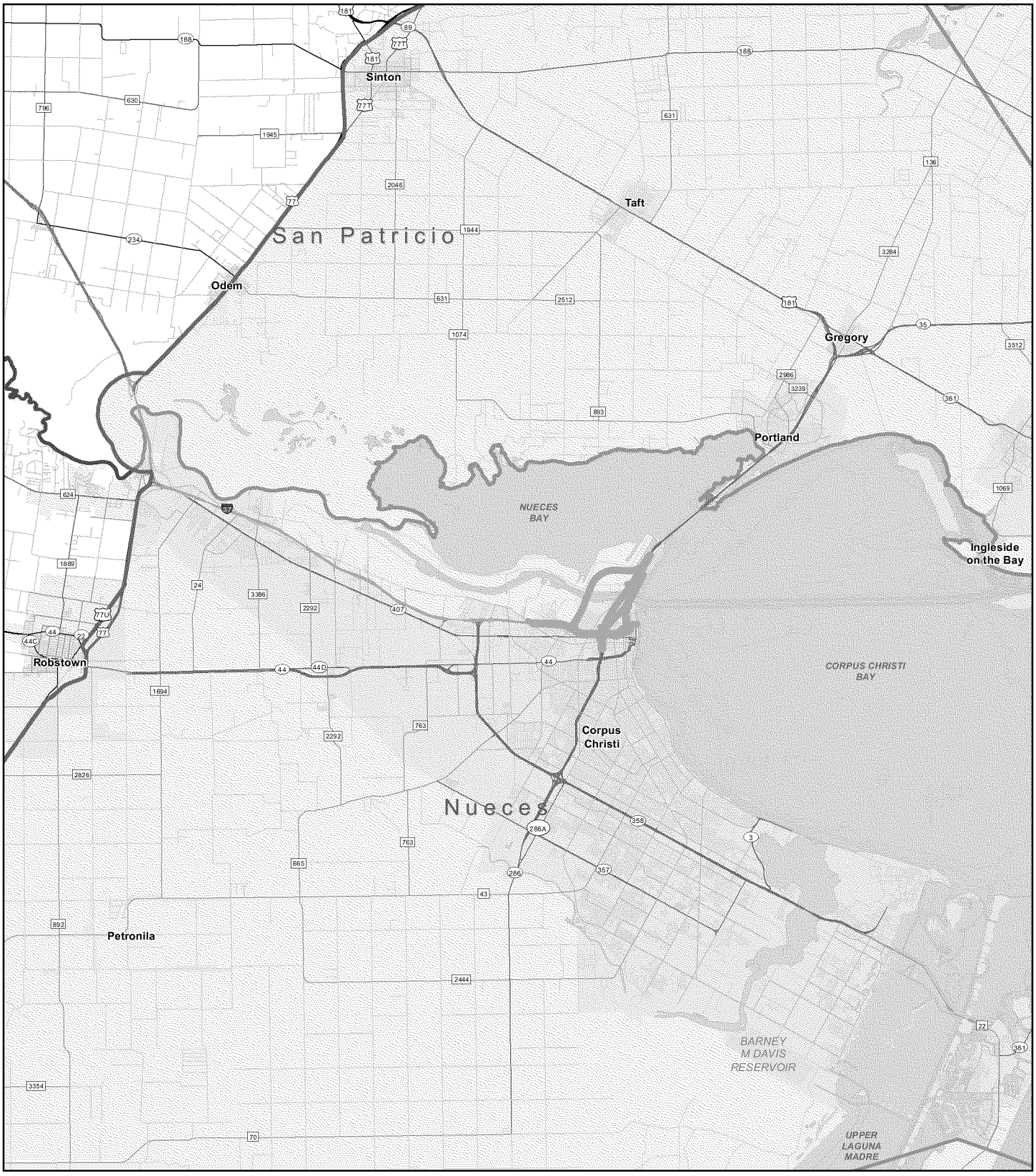
The proposed project area was investigated for encroachments into the 100-year floodplain. This information was obtained from the FEMA FIRMs for Nueces County, effective in July 1985 (map panels 4854640159C, 4854940309C, 4854940308C, 4854940316C, 4854640166C, 4854640167C, 4854640168C, 4854640169C, and 4854640285C). FEMA is currently in the process of updating the FIRMs for this area. The majority of the area in the vicinity of the proposed project lies within the 100-year floodplain (see **Figure 3.9-1**). All floodplain issues and all proposed work within the designated floodplains would be coordinated with the local floodplain administrators (City of Corpus Christi and Nueces County) since these jurisdictions participate in the NFIP. TxDOT would be in compliance with 23 CFR 650 as required.

3.10 WETLANDS AND WATERS OF THE U.S.

3.10.1 Regulatory Overview

3.10.1.1 Executive Order 11990

In 1977, President Jimmy Carter enacted Executive Order 11990, which states "…in furtherance of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), in order to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative…" Under the order, federal agencies are expected to provide leadership and take



N

0 2 4
Miles

1 inch = 4 miles

Figure 3.8-2

US 181 Harbor Bridge
Coastal Management Program Boundary

Key to Features

Proposed Project

Coastal Management Program Zone (TxGLO)

ED_005616A_00009013-00021

This page intentionally blank

N

0 2 4
Miles

1 inch = 4 miles

Figure 3.8-3

US 181 Harbor Bridge
Coastal Barrier Resources Units

Key to Features

Proposed Project

Coastal Barrier Resources System

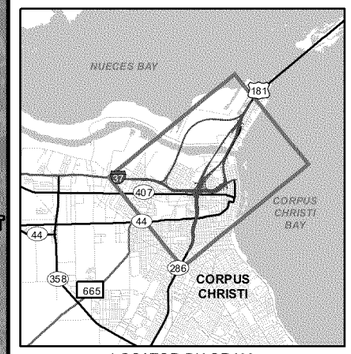
ED_005616A_00009013-00023

This page intentionally blank


RINCON CHANNEL B
RINCON CHANNEL A
Schooner Hbr
Enchanted Hbr
Beach Ave
Hayes St
Neal St
US Hwy 181
Gulfspray Ave
Surfboard Ave
Seagull Blvd
Treasure Ave
Timon Blvd
Surfside Blvd
Tourist A
Saint C
WEST
Burleson St
GREEN
ORANGE
E Causeway Blvd
Churchdal
Seigler St
Figure 3.8-4
US 181 Harbor Bridge
Submerged Lands
Key to Features
Proposed Build Alternatives
Rincon Channel Wetland Observation Area
N
0
200
400
Feet
1 inch = 400 feet
CSJ 0101-06-095

This page intentionally blank

US 181 Harbor Bridge
Draft
Environmental Impact Statement
CSJ 0101-06-095



LOCATOR DIAGRAM

WESTERN PROJECT LIMIT

Up River Rd

Buddy Lawrence Dr

Nueces Bay Blvd

37

WEST

RED

ORANGE

GREEN

Port Ave

Harbor Bridge

181

Nueces Bay

NORTHERN PROJECT LIMIT

Beach Ave

Leopard St

Lipan St

Crosstown Expressway

Shoreline Blvd

EASTERN PROJECT LIMIT

Corpus Christi Bay

Agnes St

Morgan Ave

SOUTHERN PROJECT LIMIT

286

Corpus Christi

Yacht Basin

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Key to Features

- Proposed Build Alternatives
- FEMA Zone "A" (100 Year Floodplain)

0 800 1,600
Feet
1 inch = 1,600 feet

Figure 3.9-1

FEMA Floodplains

This page intentionally blank

action to minimize the destruction, loss or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for, among other things, providing federally undertaken, financed, or assisted construction and improvements. Federal agencies are expected to "…avoid undertaking or providing assistance for new construction located in wetlands unless the head of the agency finds (1) that there is no practicable alternative to such construction, and (2) that the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use. In making this finding the head of the agency may take into account economic, environmental and other pertinent factors."

3.10.1.2 Section 404 of the Clean Water Act

The USACE regulates the discharge of dredged and fill material into wetlands and other waters of the U.S. under Section 404, subsection 330.5(a)(21) of the CWA. Section 404 of the CWA authorizes the USACE to issue permits for the discharge of dredged or fill material into waters of the U.S., including wetlands. The intent of this law is to protect the nation's waters from the indiscriminate discharge of material capable of causing pollution, and to restore and maintain their chemical, physical, and biological integrity. Any discharge into waters of the U.S. must be in accordance with Section 404(b)(1) guidelines developed by the EPA in conjunction with the USACE. Permits are required from the USACE for any activities that would result in the discharge of dredged or fill material into waters of the U.S. Regulated activities may be permitted through the USACE via Individual Permits (IP), Regional General Permits (RGP), or Nationwide Permits (NWP).

The *1987 Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) defines wetlands based on three criteria: hydrophytic vegetation, hydric soils, and wetland hydrology. In general, all three criteria must be present for an area to be characterized as a wetland. Some exceptions occur in disturbed areas or in newly formed wetlands, where one indicator (such as hydric soils) might be lacking. These areas are dealt with on an individual basis as outlined in the Field Guide for Wetland Delineation. In addition to jurisdictional wetlands as defined above, the CWA regulates impacts to other waters of the U.S. The term "waters of the U.S." has broad meaning and incorporates both deepwater aquatic habitats and special aquatic sites, including wetlands, as listed below:

1. The territorial seas with respect to the discharge of fill material.
2. Coastal and inland waters, lakes, rivers, and streams that are navigable waters of the U.S. including their adjacent wetlands.
3. Tributaries to navigable waters of the U.S., including adjacent wetlands.
4. Interstate waters and their tributaries, including adjacent wetlands.

5. All other waters of the U.S. not identified above, such as lakes, intermittent streams, prairie potholes, and other waters that are not a part of a tributary system to interstate waters or navigable waters of the United States, the degradation or destruction of which could affect interstate commerce. Note that a 2006 U.S. Supreme Court decision found that, in many

instances, isolated wetlands are not subject to Corps jurisdiction (Rapanos vs. the US [2006] and Carabell vs. the USACE [2004]).

For linear features, the Ordinary High Water Mark (OHWM) is determined by assessing a combination of factors at each site. In accordance with Section 328.3(e) of the CWA, the following factors were considered in determining the jurisdictional boundary:

- Clear, natural line on the bank;
- Shelving;
- Changes in soil;
- Destruction of terrestrial vegetation; and
- Presence of litter and debris.

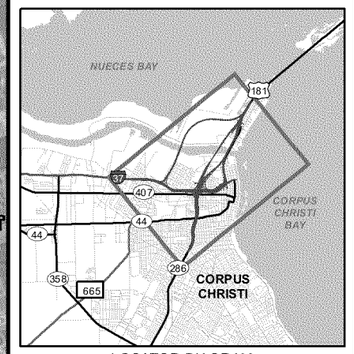
3.10.2 Determination of Jurisdictional Areas

A review of National Wetland Inventory (NWI) and National Hydrologic Database (NHD) maps (see **Figure 3.10-1**) concluded that potential waters of the U.S., including wetlands, exist within the vicinity of the proposed project. Field reconnaissance conducted September 5–6, 2012, confirmed this conclusion. Inundation and marsh vegetation was noted within the wetland observation area associated with Rincon Channel. This vegetation is described below in **Section 3.12.1.2**. Additionally, a concrete-lined drainage ditch crosses the proposed project from south to northeast, eventually emptying into the Inner Harbor. The approximate OHWM of this drainage feature is 50 feet. Potential wetlands associated with the Upland Confined Placement Areas were not observed during the field visit due to the lack of access to these areas. Once right of entry has been obtained, the 1987 Wetland Delineation routine method of wetland determination will be used to identify jurisdictional areas in the vicinity of the proposed project. Potential wetland sites will be evaluated in the field based on the Atlantic and Gulf Coast Plain Regional Supplement and wetland determination forms will be filled out in order to describe the dominant vegetative species observed at each site, along with edaphic and hydrologic characteristics.

3.10.3 Section 401 Water Quality Certification

If a USACE Section 404 permit were required for the proposed project, construction activities would require compliance with the State of Texas Water Quality Certification Program. Depending upon the acreage of surface waters, including wetlands, impacted by the proposed project, either the Tier I or Tier II 401 Certification Questionnaire and Alternatives Analysis Checklist would be completed and submitted to the TCEQ. Compliance with Section 401 of the Clean Water Act requires the use of BMPs to manage water quality on sites affecting jurisdictional waters. These BMPs would address each of the following categories: 1) erosion control, 2) post construction total suspended solids (TSS) control, and 3) sedimentation control.

US 181 Harbor Bridge Draft Environmental Impact Statement CSJ 0101-06-095



LOCATOR DIAGRAM

Key to Features

- Proposed Build Alternatives
- NHD (Linear)
- National Wetlands Inventory

N

0 800 1,600
Feet
1 inch = 1,600 feet

Figure 3.10-1

Potential Wetlands and Waters of the U.S.

This page intentionally blank

3.11 SOILS AND GEOLOGY

3.11.1 Physiography

The proposed project area resides within the broad West Gulf Coastal Plain Region, a landform bounded by the Balcones Escarpment to the north and northwest, the Rio Grande and Sierra Madre Oriental to the south and southwest, and the Gulf of Mexico to the south and southeast. Towards the Texas coast, this landform is largely flat terrain that dips gradually seaward with topographic relief expressed by a series of sub-parallel stream valleys and dunes of sand and clay along shorelines (Brown et al. 1976, 8). Slopes tend to progressively decrease moving towards the coast with older surfaces typically steeper and higher in elevation (Morton and Nummendal 1982, 4).

The proposed project is located within the Coastal Zone of the Coastal Plain Region, an area characterized by natural and man-made features including a wide array of sedimentary substrates (sand, mud, shell); geographical features derived from natural processes such as storm channels; tidal passes; wind-tidal flats; fluvial channels; biological features such as oyster reefs, marshes and swamps; subaqueous grassflats; man-made spoil heaps; reworked spoil; dredged channels; and made land (Brown et al. 1976, 2–4).

3.11.2 Area Geology

The Corpus Christi area is underlain by rocks and unconsolidated sediments that are, geologically, young in age, ranging from the Pleistocene to the modern era (Morton and Nummendal 1982, 17–20).

The Beaumont Formation underlies the proposed project at either end of the proposed limits (Barnes 1975) (see **Figure 3.11-1**). This formation, which includes barrier island and beach deposits, is characterized as mostly clay, silt, sand, and gravel. It includes mainly stream channel, point bar, natural levee, and backswamp deposits, and to a lesser extent, coastal marsh, mud flat, lagoonal, recent and older lake, clay dune, and sand dune deposits. The surface of this formation is commonly pitted by shallow lakes or dry lake beds with associated clay dunes. This formation is approximately 100 feet thick.

The Deweyville Formation, a series or related fluvial terraces, stratigraphically lies above the Beaumont Formation and more recent Holocene floodplain deposits of the outer coastal plain, deltas, and stream valleys. These deposits consist of up to three inset terraces comprised of sand, silt, clay, and gravel with inclusions of calcium carbonate. The thickness of this formation generally exceeds 50 feet.

Alluvium and Fill/spoil underlie the North Beach and Indian Point areas (Barnes 1975). Alluvium areas include clay, silt, sand, and gravel with abundant organic material. These areas include point bar, natural levee, stream channel, backswamp, coastal marsh, mud flat, clay dune, sand dune, and oyster reef deposits. Fill/spoil areas include material dredged for raising land surface above alluvium and

barrier island deposits and for creating land. The properties of these areas are highly variable and include mixed mud, silt, sand, and shell.

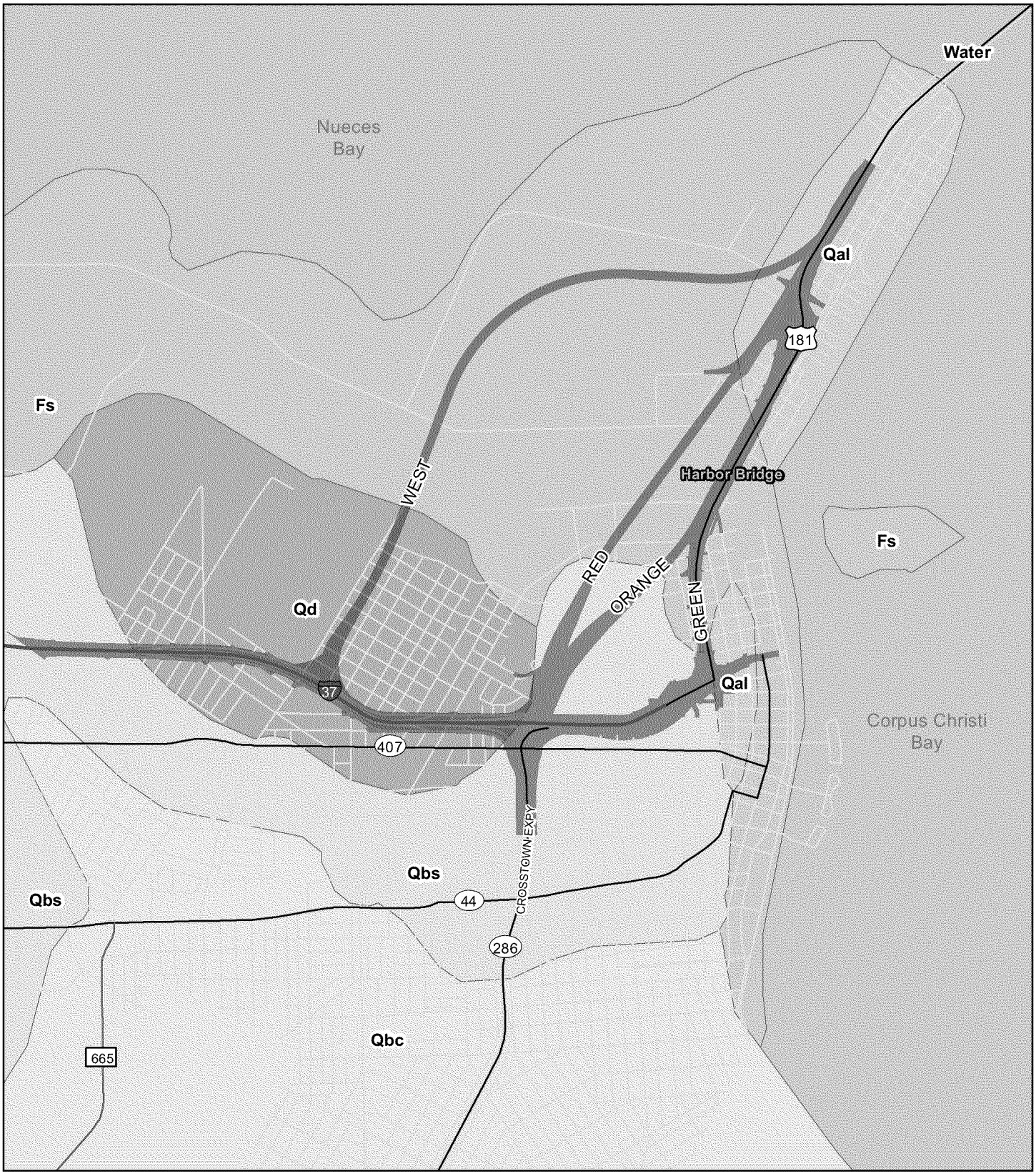
3.11.3 Area Soil Types

Beginning near the southern limit of the proposed project, soil associations progress from the Urban land (Ua) soils, to the Victoria clay formation, 0 to 1 percent slopes, (VcA), to Ijam clay loam (Ma) and Tidal flat soils (Ta), and back into Urban land (see **Figure 3.11-2**). Areas mapped as Urban land consist of unmapped soils within areas of compact urbanization where tightly spaced buildings and other structures have prevented accurate assessment and mapping. Because of this, Urban land cannot be categorized into a capability unit. The Victoria series is comprised of dark, calcareous, crumbly soils that crack when dry and swell when wet. Due to cracking, during periods of heavy rainfall, their subsoil can store large amounts of water in short spans of time. Where these areas are mapped as 0 to 1 percent slopes, water accumulates in some low areas during intense deluge. Although skilled management is needed, these soils drain enough to permit well-timed tillage. Ijam clay loams are alkaline to saline sandy clay sediment that has been dredged from the floor of lagoons, bays, rivers, canals, and bayous. Surface run off for Ijam soils is very slow and, due to poor drainage, water is often ponded. Since dredged material is saturated with sea water prior to excavation, the high salinity makes it unsuitable for cultivation. Tidal flats are made up of layers of sand, clay, and shells with inconsistent texture, thickness, and arrangement. Locales mapped as this soil type are most often barren, level areas that are above salt water at low tide and flooded at high tide (Franki et al. 1992, 8-20).

3.11.4 Important Farmland

The Farmland Protection Policy Act (FPPA), as detailed in Subtitle I of Title XV of the Agricultural and Food Act of 1981, provides protection to prime and unique farmlands, as well as farmlands of statewide or local importance. Prime farmland soils, as defined by the United States Department of Agriculture, are soils that are best suited to producing food, feed, forage, and oilseed crops. Such soils have properties that are favorable for the production of sustained high yields. Prime farmland can include cropland, pastureland, rangeland or forestland, but does not include land converted to urban, industrial, transportation, or water uses. Statewide and locally important farmlands are defined by the appropriate state or local agency as important for the production of food, feed, fiber, forage or oilseed crops. Unique farmlands are not recognized by the Natural Resources Conservation Services (NRCS) in the State of Texas.

No soil units considered by the NRCS to be prime farmland soils underlie the proposed project (Franki et al. 1992, 21-43); however, one or more of the proposed build alternatives would cross areas not within a designated urbanized area, as shown on the U.S. Census Bureau Urbanized Area Outline Map (Census 2000) for Corpus Christi, TX (Map 20287). Farmland Conversion Impact Rating Form AD-1006 would be completed for the proposed build alternatives and coordinated with NRCS if necessary.



N

0 1,500 3,000

Feet

1 inch = 3,000 feet

Figure 3.11-1

US 181 Harbor Bridge
Geologic Formations

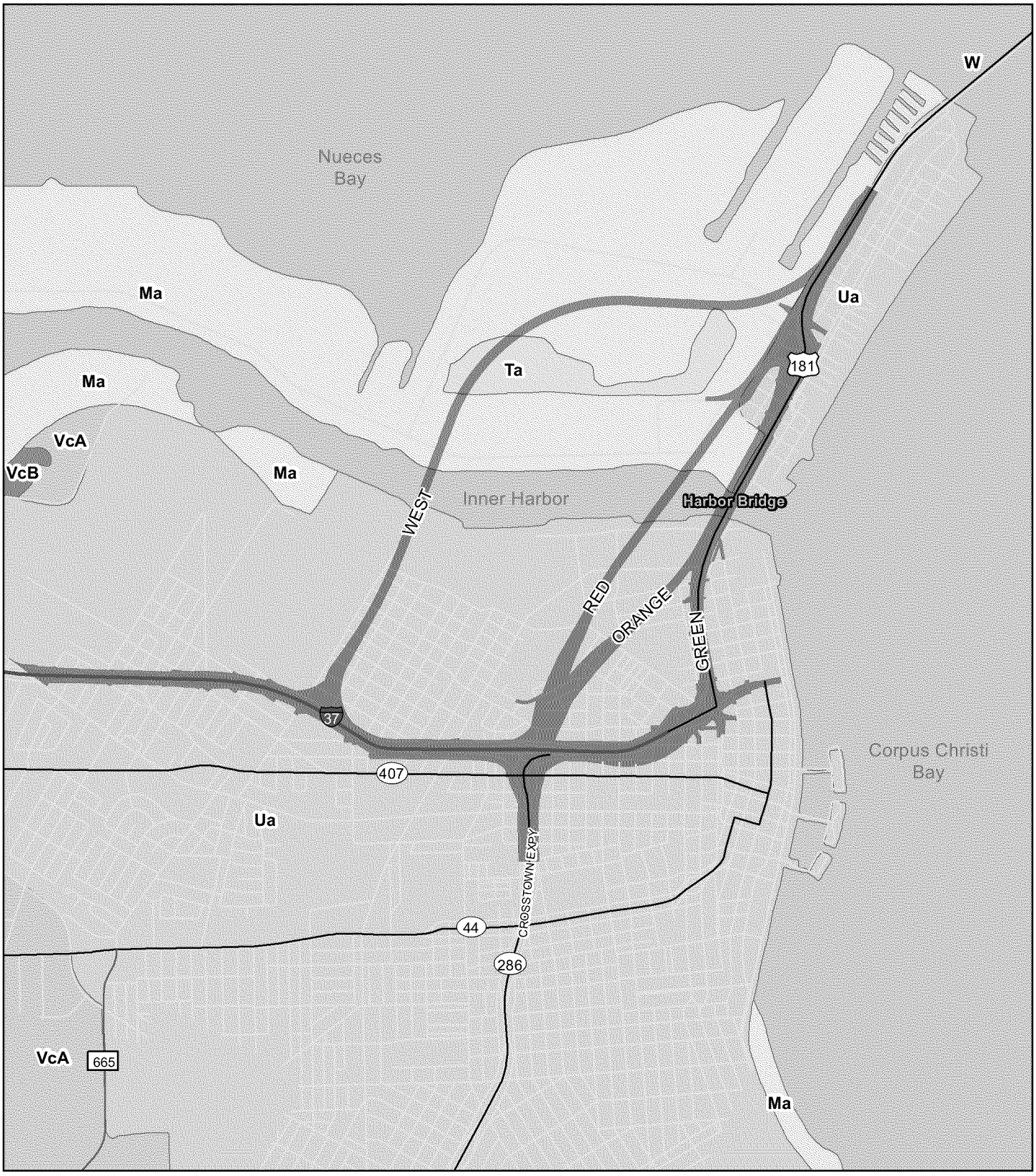
Key to Features

Proposed Build Alternatives

Geologic Formations

- Fs - fill and spoil
- Qal - alluvium
- Qbc - Beaumont Formation; areas predominantly clay
- Qbs - Beaumont Formation; areas predominantly sand
- Qd - Deweyville Formation
- Water

This page intentionally blank



N

0 1,500 3,000

Feet

1 inch = 3,000 feet

Figure 3.11-2

US 181 Harbor Bridge
Soil Types

Key to Features

Proposed Build Alternatives

Soil Types

- Ma - Ijam clay loam
- Ta - Tidal flats
- Ua - Urban land
- VcA - Victoria clay, 0 to 1 percent slopes
- VcB - Victoria clay, 1 to 3 percent slopes
- W - Water

This page intentionally blank

3.12 VEGETATION AND WILDLIFE

3.12.1 Vegetation

3.12.1.1 Regional Vegetation

The proposed project occurs entirely within the Gulf Prairies and Marshes Ecoregions of Texas (Gould 1960 and 1975) (see **Figure 3.12-1**).

The Gulf Prairies and Marshes Ecoregion is a nearly level, slowly draining plain covering approximately 9.5 million acres (Correll and Johnston 1979). This farming and ranching region is drained by slow flowing rivers, creeks, bayous and sloughs interspersed by level grasslands and low, flat woodlands and forests along the waterways in particular.

3.12.1.2 Project Area Vegetation

The project area is mapped as Urban (area within a city boundary) in The Vegetation Types of Texas (McMahan et al. 1984) (see **Figure 3.12-2**). This description accurately reflects current conditions in the vicinity of the proposed project, which is mostly within the Corpus Christi city limits and is mostly urban built-up land or otherwise disturbed land.

In accordance with Provision (4)(A)(ii) of the TXDOT–TPWD Memorandum of Understanding (MOU), an investigation was conducted to identify and map the vegetation types present in the vicinity of the proposed project and assess the potential effects of the proposed project on native vegetation. Three different vegetation communities were mapped including disturbed/urban, disturbed/dredged material, and marsh. General descriptions for each of these vegetative communities are provided in the following paragraphs, and are illustrated on **Figures 3.12-3** and **3.12-4**. It should be noted that the vegetation mapping for the disturbed/urban and disturbed/dredged material is generalized as right of entry has not yet been obtained for the majority of the proposed project area. Once access is granted, vegetation analysis of these areas will be refined.

The disturbed/urban vegetation type consists of vegetation that has been altered due to development. This includes maintained rights of ways, residential, commercial and industrial properties and vacant lots. Herbaceous vegetation within these areas consists of bermudagrass (*Cynodon dactylon*), guinea grass (*Panicum maximum*), King Ranch bluestem (*Bothriochloa ischaemum*) and johnsongrass (*Sorghum halepense*). Trees and shrubs consist primarily of Washington fan palm (*Washingtonia robusta*), Chinese tallow (*Triadica sebifera*), mesquite (*Prosopis glandulosa*), salt cedar (*Tamarix gallica*), Mexican olive (*Cordia boissieri*), orchid tree (*Bauhinia lunarioides*), ebony (*Ebenopsis ebano*), tepehuaje (*Leucana pulverulenta*) live oak (*Quercus virginiana*), hackberry (*Celtis laevigata*), anaqua (*Ehretia anacua*), retama (*Parkinsonia aculeate*) and lead tree (*Leucaena leucophala*). The palm trees are ornamental plantings primarily found within road rights of ways though a few are scattered throughout the proposed project area in residential and commercial yards. Height ranges from approximately 20 to 30